

DOCUMENT RESUME

ED 214 352

EC 141 571

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TITLE Designing Audio-Tutorial Map Systems for Blind Children: A Report of Collaborative Research and Development.
PUB DATE 81
NOTE 14p.; Adapted from a paper presented to the Special Interest Group in Geography at the Annual Meeting of the National Council for the Social Studies (61st, Detroit, MI, November, 1981).
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Geography; High Schools; Instructional Materials; Intermediate Grades; Junior High Schools; *Low Vision Aids; *Material Development; *Partial Vision; Tactile Adaptation

ABSTRACT

Low vision students can be helped to gain an understanding of map reading and geography by means of products developed by the American Printing House for the Blind. Among those products are a series of eight land form models with accompanying audiotapes, a series of continental color coded relief maps, and 18 audiotapes for the six continents. The audiotapes, which address such topics as general map exploration, countries in each continent, major cities, and historical facts, combine entertainment with the cognitive material, and are designed for students in grades 5 through 10. (CL)

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DESIGNING AUDIO-TUTORIAL MAP SYSTEMS FOR BLIND CHILDREN:
A REPORT OF COLLABORATIVE RESEARCH AND DEVELOPMENT

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Girls and boys with visual handicaps in the United States are being assisted in moving from exclusive dependence on special classes into the mainstream of academic life. While students with severe visual impairment continue to need the services of specialists--and an important role exists for residential centers--thousands of vision-impaired youngsters attend regular classes for a major portion of their school day.

Regardless of the educational arrangement, lack of normal vision imposes an extra learning burden. Every blind person must undertake an arduous program to develop mobility, learn to eat and dress without assistance, and otherwise achieve an acceptable level of independence. This supplemental curriculum extracts a heavy toll. The need to master it while simultaneously pursuing regular school learning means that a majority of low vision students lag 1-4 years behind their sighted agemates.

Nevertheless, individuals with visual impairment have goals similar to others in our society. A civilization based on technology requires basic literacy skills and a broad understanding of the physical world. Even though

*Adapted from a paper presented to the Special Interest Group in Geography at the 61st Annual Meeting of the National Council for the Social Studies. Detroit, Michigan; November 1981.

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the undertaking is extremely difficult without vision, spatial learning and concepts from geography and the earth sciences are as important to legally blind students as to those with normal vision.

Most legally blind persons have at least a small amount of residual vision. In past decades this often was regarded as of no particular consequence; the stress was placed on learning Braille and other substitutes for visual acuity. In recent years, however, the extraordinary value and utility of even the smallest amount of vision has been demonstrated. Current practice is to utilize residual vision to the maximum extent possible.

Lack of Appropriate Map Materials

Concepts about objects that cannot be explored visually or tactually are likely to be undeveloped or erroneously formed by either blind or sighted persons. Indeed, how could the concept of a mountain, valley, peninsula, or river be adequately formed when these things can neither be seen nor encompassed by touch? Even sighted persons frequently require pictures or model representations to complement and extend their limited repertory of direct experiences. Yet, despite an abundance of audio-visual materials, Americans have a long history of poor child and adult performance in both map reading and generalized knowledge of geography.¹

Without special maps and other materials, low vision students will be denied shared learning experiences with their sighted classmates. But appropriate materials generally are unavailable in the commercial marketplace. Furthermore, the scattering of three-dimensional maps that can be

purchased are designed primarily as supplements to normal vision. While regular students can use the three-dimensional maps to feel as well as see features of the terrain, the process is more one of confirmation than discovery. Without visual perception as a baseline, the scale and mode of presentation on such maps is generally unsuitable.²

This conclusion can be verified by securing a government issue or commercial raised relief map of an unfamiliar area. Using a blindfold or working in a totally dark room, employ the touch of your fingers to locate places, measure distances, and identify landforms. To be truly fair, assume that you have never possessed vision and are using your tactual senses to explore an area about which you have no prior knowledge. Incidentally, it may be shocking to learn that some of the myths about development of unusual tactual skills among the blind may not be true. A recent study shows that sighted persons often outperform visually impaired students on tactual tasks. As with the other senses, gaining and processing information tactually depends on an interplay of signals and experience. It is experience with vision that enables most individuals to create and manipulate mental pictures as a complement to their tactual inputs.³

Constraints in the Marketplace

Unfortunately, the demand for raised surface maps suitable for visually impaired students is too small to sustain a commercial market. In 1980, there were only 35,814 students in the United States registered as legally blind.⁴ Furthermore, the cost of developing instructional material for the

visually handicapped is unusually high. The result is that only a handful of non-profit organizations, with tax support and private benefactors, can afford the empirically verified approach required in work of this type.

Role of the American Printing House for the Blind

The American Printing House for the Blind is such an organization. Chartered in the Commonwealth of Kentucky in 1858, the activities of APHB were expanded in 1879 through passage of special legislation by the United States Congress. For more than a century APHB has received annual appropriations to manufacture educational textbooks and other aids for legally blind students of less than college level.

Government funds are supplemented by charitable contributions and the sale of materials to state and local agencies. Among other things, the Printing House reported production in 1980 of a recorded version of the World Book Encyclopedia; 53 million pages of Braille; over 1100 textbook titles in oversize type; recorded editions of Reader's Digest and Newsweek magazines; "talking books" on phono records and tape; science models; math kits; various pieces of specialized equipment; and several globes and maps.⁵

The author has collaborated on projects with the American Printing House for the Blind since 1970. This association has been primarily with the Department of Educational Research, established in 1952. Personnel of the department have been responsible for a number of investigations into characteristics of young visually impaired persons and have sought ways to

meet their educational needs. Results from dozens of studies have become a major factor in the development, testing, and distribution of publications and other materials produced by the APHB. Significantly, the head of the research department during one of its most productive periods was named President and chief executive officer of the Printing House in 1978.

Creation of Models

Production of maps and globes by the American Printing House has a long history. In recent years these have included individual embossed maps, an atlas of embossed maps, continental wall plaques, and relief globes. While the wall plaques and embossed maps are being phased out of production, several new aids have appeared. One of these is a series of eight landform models, depicting the 42 most commonly encountered geographical terms for elementary school students in grades 4, 5, and 6.

How does anyone know which 42 terms appear most frequently? Because APHB researchers conducted an extensive review and tabulated geographic terminology from six sets of social studies textbooks and more than a dozen sets of map study materials for sighted children in grades 4-6.⁶

Development of Audio Supplements

The author's role was to take the landform models and create a series of audio tapes to accompany them. Scripts and preliminary tapes were developed and submitted to APHB personnel for technical review. Following this, field trials were held with visually impaired classes. On the basis of

test data and the experiences of teachers and students, revisions were suggested and a final set of master tapes produced. An instructor's manual with general teaching suggestions, a set of geography definitions, tape scripts, and lesson plans also was prepared. The eleven "Doobie the Brain" tapes and teacher's manual now are reproduced and distributed by the Printing House for the Blind.⁷

Simplified Continental Relief Map

In response to recommendations of a curriculum advisory group composed of educators who work with the visually impaired, the Printing House developed a series of simplified continental relief maps in the mid-1970's. Designed primarily as supplementary aids for visually handicapped students, the maps contain many of the prominent features identified in textbooks and geographical reference materials for middle and junior high school grades. The six maps--Africa, Asia, Australia, Europe, North America, and South America--are each approximately 44 cm. by 56 cm. All are coded with standard APHB colors for low vision students. These are low-reflective hues--with blue for water areas, light yellow for most land, and red for a few prominent peaks and mountain ranges. The maps are molded of polyurethane, a lightweight material resembling wood. Land areas are raised, on a base approximately 3 mm. Other special features include:

1. Texturing of oceans and other water areas, using a pattern selected in previous research on tactile discriminability and preference.
2. A scale representing 300 miles, as a raised horizontal bar on each of the maps.

3. A general vertical relief of 1 inch equals 26,000 feet, measured from the raised base.
4. Major river valleys represented by wide cuts in the land areas, to make these discernible to students with little or no residual vision.
5. High Rails (approximately 29mm.) around the outside perimeter, to permit "flooding" of the ocean areas of the waterproof map.
6. A system for marking the equatorial line with a cut in the left and right rails, so that a cord or elastic stretched across the map will indicate the location of the equator.

Accompanying Tape Series

Production of a new map series is a vitally important step. Getting the maps into frequent use and helping visually handicapped students grasp basic concepts about the areas represented is a task of equal importance.

My part of the project involved development of 18 audio tapes, three for each continent. Instructions on the tapes had to conform to the vocabulary used by the blind. References to the "top" or "bottom" of a map or directions to move a hand "down along a coastline" are out of order; instead, directions for horizontal movements must be given in terms of right-left or near-far edges.

Geographers also have special terms and conventions. In creation of new materials, therefore, it is important to check the accuracy and appropriateness of all definitions and explanations. Draft scripts of the first seven tapes; color photographs of the North America, South America, and Europe maps; and background information on the project were sent to a panel composed of six distinguished geographic educators. This was

supplemented with individual and telephonic consultations. In addition, each review panelist provided a written commentary.

The suggestions were directed both at technical matters and at better ways to create instructional media for children. Later, other scripts and the maps themselves were critiqued by a member of the panel who was a colleague on the Peabody campus. Dr. Jewell Phelps is a past-president of the National Council for Geographic Education and a frequent author of teacher materials published by that organization.

The first tape for each continent provides for a tactual exploration of the land surface, islands in the adjacent seas, mile scale, and overall orientation to the map and continent. The search is highly directive and specific, because children with low vision find it easy to become "lost" in tactual exploration of this type.⁸ Because of the curriculum sequence commonly followed in social studies, nearly all students experience an early encounter with their "home continent" of North America. Therefore, North America is anticipated as the likely starting place for the sequence of six maps and 18 tapes.

Tape #1 for North America begins with a quick general orientation and some specific references to landform definitions. For many students, it is

*Review panel members were Phillip Bacon (U. of Houston), Charles F. Gritzner (U. of Houston), Gary A. Manson (Michigan State), Jewell A. Phelps (Peabody), Roberta A. Raithel (Texas Education Agency), and Noel Ring (Norwich U.). All were past-presidents and/or members of the Board of Directors, National Council for Geographic Education. The panel was appointed by the American Printing House for the Blind, in consultation with the author.

a link with the earlier landform series. North America is named and identified as one of the seven continents on Planet Earth; the Arctic, Atlantic, and Pacific Oceans are located; and the color coding system of the map given. Definitions (in the context of actual features on the relief map) include coastline, islands, mountains, plains, mountain ranges, source and mouth of river, and peninsula.

The second tape in the series usually contains some review, continues the general exploration of the map, and identifies particular features by name. In the North America series, for example, Tape #2 locates and names the Appalachian and Rocky Mountains; the Mississippi and St. Lawrence Rivers; the Alaskan, Baja California, Yucatan, and Florida peninsulas; the Great Lakes; and the islands of Cuba and Hispaniola. It is not intended that listeners should memorize the location of these features; however, they should begin to make connections between names of places they have encountered in reading, social studies, and out-of-school with the shapes, ridges, depressions, and spaces on the relief map.

Tape #3 in each series focuses more on the concerns and impact of humans. Countries, major cities, and historical facts are discussed, although "political" features are not marked on any of the maps. Teachers, of course, can mark such features with string, clay, or other means. Additional physical features are named on the third tape, along with information about them. In the case of North America, Greenland is "discovered" and identified as the largest island in the world. Other places and areas identified

include Hudson Bay, the Isthmus of Panama, and Newfoundland. A small amount of historical data also are given on such topics as aboriginal and later settlement patterns.

Length of the 18 tapes varies somewhat but most have a playing time of 20 to 30 minutes. Fortunately, visually impaired children are quite experienced in the use of tape recorders, so they can be depended on to start and stop when needed or to rewind for review of a section.

Motivational Factors

Selecting and organizing content is an important aspect of program development, but unless students find the material interesting and focus their attention on it the effort may be to no avail. The author's work with the research phase of Sesame Street⁹ and with the landform tape project indicated a need to mix entertainment with the cognitive material.

Each tape in the series should be interesting enough to (1) motivate students to listen closely, (2) want to repeat the tape, and (3) look forward to the next cassette. This goal had been met in the earlier landform series. With an older audience and a heavier content load, however, there was concern that the continental relief map tapes might turn out to be dull, and remain in their boxes.

The theme and characters vary, but each of the six sets has a distinctive storyline. All are imaginative but plausible. In the North America tapes, for example, an unmanned flying saucer is discovered in the Pacific Northwest. When the tapes aboard are decoded, we can listen to them.

Strange "computer-synthesized" voices describe the continent. Listeners follow along on the model provided--a relief map of North America.

The Future

Reactions from students in grades 5-10, teachers, and members of the APHB staff were favorable to the preliminary versions--but many constructive suggestions were offered. On the basis of these comments and field trial data, the three North America tapes have been completely remade to professional standards and the masters forwarded to the Printing House for reproduction and distribution. The other 15 tapes have gone through various stages of the field test and review process; it is anticipated that the entire audio-tutorial series will be available to classes serving visually impaired students within the next year or two.

More important than creation of the two audio-tutorial systems is validation of a process. By following a careful research and development sequence from needs assessment through distribution of a final product, a means to produce effective materials for visually impaired children is confirmed. The process will benefit from further refinements, of course, and by application in new areas. Even in the areas of geography and earth science, much remains to be accomplished if the deficits accompanying visual impairment are to be overcome or minimized.

Reference Notes

¹For a sampling of research and authoritative writing on the struggle for geographic and map reading literacy over a span of nearly 50 years, see G. F. Howe, "A Study of the Ability of Elementary School Pupils to Read Maps," and Mary T. Thorp, "Studies of the Ability of Pupils in Grades Four to Eight to Use Geographic Tools," in Chapter 29, The Teaching of Geography (32nd Yearbook of the National Society for the Study of Education), 1933; Sister M. Stephanie Zimmer, A Diagnosis of Map Skill Deficiencies in Elementary School Children (Ph.D. dissertation, Catholic U. of America, 1967); Haig A. Rushdoony, "A Child's Ability to Read Maps: A Summary of the Research," Journal of Geography (April 1968): 213-22; Jack W. Miller, "A Content/Operations/Product/Time Model for Research in Geographic Learning," Journal of Geography (April 1972): 233-37; Donald O. Schneider, "The Performance of Elementary Teachers and Students on a Test of Map and Globe Skills," Journal of Geography (September 1976): 326-32; Duane M. Giannangelo and Bruce M. Frazee, "Map Reading Proficiency of Elementary Educators," Journal of Geography (February 1977): 63-65; and John J. Chiodo, "New Directions for Map and Globe Skills," Curriculum Review (February 1980): 85-87.

²Carson Y. Nolan and June Morris, Improvement of Tactual Symbols for Blind Children: Final Project Report. (Louisville: American Printing House for the Blind, 1971).

³Suzanna Millar, "Spatial Representation by Blind and Sighted Children," Journal of Experimental Child Psychology (June 1976): 460-79.

⁴112th Annual Report. (Louisville: American Printing House for the Blind, 1980), p. 6.

⁵*Ibid.*, pp. 6-7.

⁶Frank L. Franks and Carson Y. Nolan, "Development of Geographical Concepts in Blind Children," Education of the Visually Handicapped (March 1970): 1-8.

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⁸See Edward P. Berla, "Behavioral Strategies and Problems in Scanning and Interpreting Tactual Displays," New Outlook for the Blind (October 1972):

227-286 and Edward P. Berla and Marvin J. Murr, "Searching Tactual Space," Education of the Visually Handicapped (May 1974): 49-58.

⁹Jack W. Miller and Rom Skavarcus, Does Sesame Street Teach? Performance Gains of Preschool Viewers and Nonviewers. (Nashville: Childrens Television Workshop Group, 1970).